CLAIMS

1. A method for generating electrical energy within a tyre, the method comprising:
   - associating a housing including a piezoelectric element to a tyre portion in correspondence of a tyre tread area, the piezoelectric element being disposed substantially along a plane orthogonal to a radial direction of said tyre and having a first end substantially fixed to said housing and a second end fixed to a loading mass, a gap being formed between at least one inner wall of said housing and an outer surface of said loading mass;
   - rotating said tyre on a rolling surface at a first rotation speed lower than a given speed, so as to cause said loading mass to oscillate within said gap, thereby leading to a first deformation of said piezoelectric element during said tyre rotation;
   - rotating said tyre on said rolling surface at a second rotation speed higher than said given speed, so as to cause said loading mass to contact said inner wall during a first fraction of a complete tyre revolution, during said first fraction said tread area corresponding to said tyre portion being not in contact with the rolling surface, and to cause said loading mass to oscillate within said gap during a second fraction of a complete tyre revolution, during said second fraction said tread area corresponding to said tyre portion being in contact with the rolling surface, thereby leading to a second deformation of said piezoelectric element during said tyre rotation;
   - collecting electrical energy generated from said first and said second deformations of said piezoelectric element.

2. The method according to claim 1, wherein said tyre portion is a portion of an inner surface of the tyre.

3. The method according to claim 1 or 2, wherein the piezoelectric element has a longer side disposed substantially according to an axial direction of the tyre.

4. The method according to anyone of the previous claims, wherein during said rotation at said second rotation speed, said loading mass oscillates around a first equilibrium position, substantially disposed along said plane orthogonal to said radial direction of the tyre.

5. The method according to claim 4, wherein during said rotation at said first rotation speed, said loading mass oscillates around a second equilibrium position within said gap, different from said first equilibrium position.

6. The method according to any one of the previous claims, wherein said given speed is comprised between 30 km/h and 70 km/h.

7. The method according to claim 6, wherein said given speed is comprised between 40 km/h and 60 km/h.

8. A system for generating electrical energy comprising:
   - a tyre;
   - a power supply comprising a piezoelectric element, associated to a tyre portion in correspondence of a tyre tread area;

   wherein
   - said piezoelectric element is disposed within a housing so as to have a first end substantially fixed to said housing and a second end associated to a loading mass, a gap being formed between at least one inner wall of said housing and an outer surface of said loading mass;
   - said piezoelectric element is positioned substantially along a plane orthogonal to a radial direction of said tyre;
   - said piezoelectric element, said loading mass and said gap are sized so as to obtain:
     a) during rotation of the tyre on a rolling surface at a first rotation speed lower than a given speed, an oscillation within said gap of said loading mass associated to said piezoelectric element;
     b) during rotation of the tyre on said rolling surface at a second rotation speed higher than said given speed, a contact of said loading mass with said inner wall of said housing during a first fraction of a complete tyre revolution, during said first fraction said tread area

corresponding to said tyre portion being not in contact with said rolling surface, and an oscillation within said gap of said loading mass associated to said piezoelectric element during a second fraction of a complete tyre revolution, during said second fraction said tread area corresponding to said tyre portion being in contact with the rolling surface.

9. The system according to claim 8, wherein said tyre portion is a portion of an inner surface of the tyre.

10. The system according to claim 8 or 9, wherein of the piezoelectric element has a longer side disposed substantially according to an axial direction of the tyre.

11. The system according to anyone of claims 8 to 10, wherein said given speed is comprised between 30 km/h and 70 km/h.

12. The system according to claim 11, wherein said given speed is comprised between 40 km/h and 60 km/h.

13. The system according to any one of claims 8 to 12, wherein a resonance frequency of said piezoelectric element associated to said loading mass within said housing is higher than 150 Hz.

14. The system according to claim 13, wherein said resonance frequency is higher than 200 Hz.

15. The system according to claim 14, wherein said resonance frequency is higher than 300 Hz.

16. The system according to any one of claims 8 to 15, wherein said loading mass is lower than 3 gr.

17. The system according to any one of claim 8 to 16, wherein said loading mass is U-shaped.

18. The system according to any one of claims 8 to 17, wherein said gap has a maximum extent of 400 μm.

19. The system according to any one of claim 8 to 18, wherein said piezoelectric element is a bimorph element.

20. The system according to any one of claims 8 to 19, wherein said piezoelectric element is a planar element.

21. The system according to any one of claims 8 to 20, wherein a material of said piezoelectric element is PZT.

22. A system for monitoring at least one operating parameter of a tyre comprising:

- a system for generating electrical energy including a power supply according to any one of claims 8 to 21;
- a sensor device including a measurement device adapted to measure said at least one operating parameter and a transmitter device adapted to transmit said measured parameter, associated to said power supply;
- a receiving device adapted to receive said transmitted measured parameter.

23. The system according to claim 22, wherein said measurement device includes a pressure sensor.

24. The system according to claim 22 or 23, wherein said measurement device includes a temperature sensor.

25. The system according to any one of claims 22 to 24, wherein said measurement device includes an acceleration sensor.

26. The system according to any one of claims 22 to 25, wherein said measurement device includes a counter of tyre revolutions.

27. The system according any one of claims 22 to 26, wherein said sensor device includes a microcontroller being adapted for enabling said measurement device and said transmitter device, associated to said power supply.

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